

WHAT IS CLAIMED IS:

1. A system to interactively access and analyze temporal data relationships that change over time, the system comprising:

- 5       one or more 4D portal storage mediums containing 4D portal information;
- one or more 4D browser programs adapted to access the one or more 4D portal storage mediums and convert the 4D portal information contained therein into one
- 10       or more 4D objects rendered in a 3D scene, wherein the 4D browser programs are adapted to manipulate the 4D objects in three spatial dimensions and a fourth time dimension according to the 4D portal information so as to enable the temporal and spatial manifestation of
- 15       the 4D objects in the 3D scene; and
- one or more 4D portal windows adapted to receive and display the 4D objects in the 3D scene rendered by a 4D browser program.

2. The system according to claim 1, further comprising:

          one or more information databases from which the 4D portal information is derived.

3. The system according to claim 2, wherein the 4D portal information includes 4D object definitions, 4D object attributes, 4D object actions and 4D object time-stamped audit trail data.

4. The system according to claim 3, wherein the 4D portal information is augmented with spatial manifestation definitions, guideway definitions and 3D visual models for each 4D object definition.

5. The system according to claim 1, wherein the 4D browser program creates an interactive 3D computer-generated scene in one or more 4D portal windows that is manipulated by one or more users of the system.

6. The system according to claim 1, further comprising:

a communications system connected between the one  
5 or more 4D portal storage mediums and one or more 4D browser programs, the communications system being adapted to process 4D portal information into 4D object states and transmit the 4D portal information and the 4D object states to one or more 4D browser  
10 programs.

7. The system according to claim 1, wherein the 4D portal information represents a physical object.

8. The system according to claim 1, wherein the 4D portal information is an abstract dataset which is represented by geometric shapes.

9. The system according to claim 1, wherein the 4D portal information is organized in a spatial hierarchy.

10. The system according to claim 3, wherein the 4D object attributes correspond to one or more data fields of the information database from which the 4D portal information is derived.

11. The system according to claim 3, wherein the 4D object attributes are calculated by applying a function to one or more data fields of the information database.

12. The system according to claim 10, wherein the 4D object actions represent events in time which effect one or more 4D object attributes.

13. The system according to claim 4, wherein the 4D object attributes and 4D object actions are associated with one or more spatial manifestation definitions.

14. The system according to claim 13, wherein the spatial manifestation definitions include insertion/removal of a 4D object, color, color ramp, scale, orientation, translation, articulation, texture patterns, lighting effects, translucency, or shape.

15. The system according to claim 14, wherein the spatial manifestation definitions further include 4D temporal fade in/out and guideway translation/orientation definitions utilized by the 4D browser program to manipulate one or more 4D objects in the 3D scene.

16. The system according to claim 15, wherein the spatial manifestation definitions are static.

17. The system according to claim 15, wherein the spatial manifestation definitions are progressive.

18. The system according to claim 6, wherein the 4D browser program includes access privileges to the 4D storage mediums, and wherein the communications  
5 system is further adapted to validate the 4D browser program access privileges to the 4D storage mediums in response to a request for access by one or more of the 4D browser programs.

19. The system according to claim 18, wherein the access privileges to the 4D storage mediums include open, query, select, update and close, and wherein the  
5 communication system responds to the request for access by retrieving the corresponding 4D portal information from the 4D portal storage medium.

20. The system according to claim 19, wherein the communication system processes the 4D portal information into 4D object states and webpage content  
5 and transmits the 4D portal information, the 4D object states and the webpage content to the 4D browser program according to the request for access.

21. The system according to claim 3, wherein the 4D browser program is further adapted to generate 4D object states from the 4D portal information.

22. The system according to claim 21, wherein the 4D portal information is temporally and spatially binned so as to represent time frames of the 4D object states at selectable temporal resolutions of the 4D objects in selectable levels in a spatial hierarchy.

23. The system according to claim 1, wherein the 4D browser program is connected between the one or more 4D portal windows by a shared electronic network system.

24. The system according to claim 6, wherein the communications system is connected between the one or more 4D portal storage mediums and the one or more 4D browser programs by a shared electronic network system.

25. The system according to claim 4, wherein the guideway definitions and the 3D visual models of each 4D object definition are spatially referenced to and visually rendered in the 4D portal windows.

26. The system according to claim 1, wherein the 4D browser program is further adapted to provide an interactive time control which specifies a starting time value and an ending time value for the fourth time dimension by moving the time control forward or backward in selectable time increments, process the 4D portal information corresponding to the time increment between the starting time value and the ending time value so as to maintain a temporal context of the one or more 4D objects in the 3D scene, and utilize the

temporal context to determine the one or more spatial manifestations to be applied to the one or more 4D objects in the 3D scene between the starting time  
15 value and the ending time value.

27. The system according to claim 1, wherein the 4D browser program is further adapted to modify the 4D portal information and save the modifications on the one or more 4D portal storage mediums.

28. The system according to claim 1, further comprising:

a local storage medium, and wherein the 4D  
5 browser program is further adapted to modify the 4D portal information and save the modifications on the local storage medium.

29. The system according to claim 22, wherein the time frames include one or more time masks which specify repeating time periods.

30. The system according to claim 1, wherein the 4D browser program is further adapted to enable the selection of a temporal and spatial manifestation of a 4D object in the 3D scene with a pointing device.

31. The system according to claim 1, wherein the 4D browser program is further adapted to save the 3D scene each time the 3D scene is rendered in the 4D  
5 portal window as 4D objects are manipulated temporally or spatially.

32. A method for generating a temporally and spatially manipulatable 4D portal from one or more information databases, comprising:

- identifying a representative set of 4D object types from the one or more information databases;
- defining spatial manifestations for each 4D object type;
- organizing the 4D object types and spatial manifestations into a set of 4D object definitions;
- creating a 3D visual model for each 4D object type; and
- creating one or more 4D objects in a 3D scene based on the 4D object definitions.

33. The method according to claim 32, further comprising:

- organizing the 4D object types into a 4D object spatial hierarchy.

34. The method according to claim 33, further comprising:

- identifying 4D object attributes from the one or more information databases; and
- identifying 4D object actions from the one or more information databases, wherein the spatial manifestations are defined for the 4D object attributes and the 4D object actions, and wherein the set of 4D object definitions are organized according to the 4D object types, the 4D object spatial hierarchy, the 4D object attributes, the 4D object actions and the spatial manifestations.

35. The method according to claim 34, further comprising:

creating guideway definitions based on the spatial manifestations.

36. The method according to claim 35, further comprising:

generating a 4D object audit trail from the one or more information databases.

37. The method according to claim 36, further comprising:

organizing the 4D object definitions, the 4D  
5 object audit trail, the 3D visual models and the guideway definitions into a 4D portal database.

38. The method according to claim 37, further comprising:

updating the one or more information databases from which the 4D portal information was derived; and  
5 updating the 4D portal database in response to updates to the one or more information databases from which the 4D portal information was derived.

39. The method according to claim 38, wherein the 4D portal database is generated by a database management system.